

M F ELECTRONICS CORP.

118 EAST 25th ST. • NEW YORK, N. Y. 10010

TEL.: 212 OR 4-5360

Preliminary Specifications
August 1966

AC Modulator and Demodulator

310-1 and 410-1

General Description:

The 310-1 and 410-1 are a modulator-demodulator pair which are intended to facilitate transmission of low frequency waves from point to point via ordinary voice communication links. This is accomplished by causing the low frequency data to FM modulate a voltage controlled oscillator, the 310-1, operating at a nominal frequency of 2500 Hz. The spectrum of interest is therefore shifted from the very low data frequency to the carrier frequency of 2000 to 3000 Hz. This frequency which is similar to voice frequency, can easily be transmitted by telephone line, walkie-talkie or citizens band transmitter-receiver from one point to another. After RF detection, the signal is re-processed by the use of the 410-1 demodulator into the original AC signal lying in the low frequency range, at which point it may be recorded on a graphic recorder or displayed on an oscilloscope.

The unique feature of the 310-1 and 410-1 lies in the fact that they only utilize AC data and therefore restrict the case of general data transmission which has commonly been used in the standard telemetry systems. Since there is no requirement for DC capability, the circuit requirements are simplified with resulting very low cost per pair, while the transmission of information is excellent for AC signals only. In addition, these units are specified for field use over a wide temperature range and may therefore be readily employed in many industrial types applications where the use of voltage controlled oscillators and demodulators has previously been impossible due to high cost.

Both units are sturdily built with octal plugs for simple connections. They take advantage of the use of many parts which are now manufactured in very high quantity with resultant high quality and reliability. These units are specifically designed for use under severe environmental and mechanical conditions.

Systems Specifications:

The frequency and phase response are dependent upon the load on the demodulator:

Demodulator Load	No Load-Output taken from pin 4	20k Ω Load-Output taken from pin 3	600 ohms Load Output taken from pin 3
Frequency Response: $\pm 1/2$ dB between the frequencies:	0.5 Hz to 200 Hz	5 Hz to 200 Hz	25 Hz to 200 Hz
Phase Response: Within 5 $^{\circ}$ of straight line between the frequencies:	4 Hz to 200 Hz	10 Hz to 200 Hz	40 Hz to 200 Hz

The following specifications apply under all load conditions:

Dynamic Linearity:

The amplitude distortion is less than 1/2 decibel from 0.05 volts VRMS to 1.0 volts RMS.

Noise:

The noise does not exceed .025 volts RMS under conditions of zero modulation.

Battery Voltage Sensitivity:

Each unit contains a zener regulator and is therefore not affected by battery voltage variations within the range of 10.0 to 14.0 volts DC, over the complete temperature range.

Temperature of Operation:

The temperature of operation is -15 to 150 $^{\circ}$ F.

Signal Input-Output Capabilities:

The normal maximum input to the modulator is 1 volt RMS and this will produce an output voltage from the demodulator of 1 volt RMS.

An auxiliary input at the modulator can be used to accommodate a 2 volt peak to peak signal for full modulation, while auxiliary connections at the demodulator can be used to reduce the sensitivity of the demodulator by 3 dB, to correct scale factor if required.

310-1 VCO Modulator

Power Input: +10.5 to +13.5 volts at 25 ma., max.

Deviation: 1 VRMS, typical, will produce 150 cps RMS deviation, or .7 VRMS, typical will produce 150 cps RMS deviation (higher sensitivity)

Data Input: Input is 0 to 1 VRMS within the frequency range of 1 to 200 cps

Output: The typical output is 1 VRMS into 600 ohms with harmonic distortion less than 5%. The incidental AM is held to within 1 db.

Sub-Carrier
Frequency: 2500 cps $\pm 10\%$

Temperature of
Operation: -15 to +150 degrees Fahrenheit

Size: 1- 3/8" sq. x 2" high, with octal plug

410-1 FM Demodulator

Power Input: +10.5 to 13.5V at 25 ma., max.

Input FM Carrier: 1 VRMS into 5k Ω or greater at 2500 cps $\pm 10\%$

Maximum Output: 1 VRMS into 600 ohms

Output Harmonic
Distortion: Less than 5% (2-1/2% typical)

Temperature of
Operation: From -15 to +150^o Fahrenheit

Sensitivity: 150 cps RMS deviation will produce 1 VRMS. Sensitivity can be reduced smoothly to -3 db with external variable resistor

Frequency
Response: The frequency response of the transmitter and receiver, as a system is within ± 1 under all conditions.

Size: 2" sq. x 3-1/8" high, with octal plug

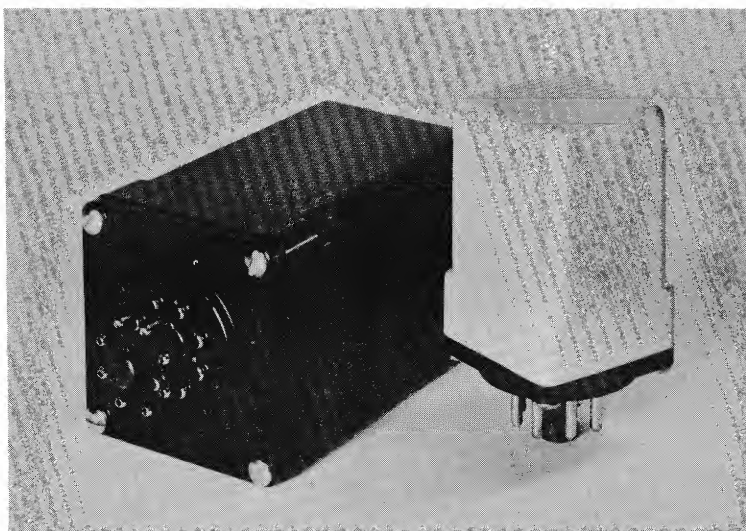


Fig. 1. Model 310-1 AC FM Modulator (white) and Model 410-1 AC FM Demodulator (black)

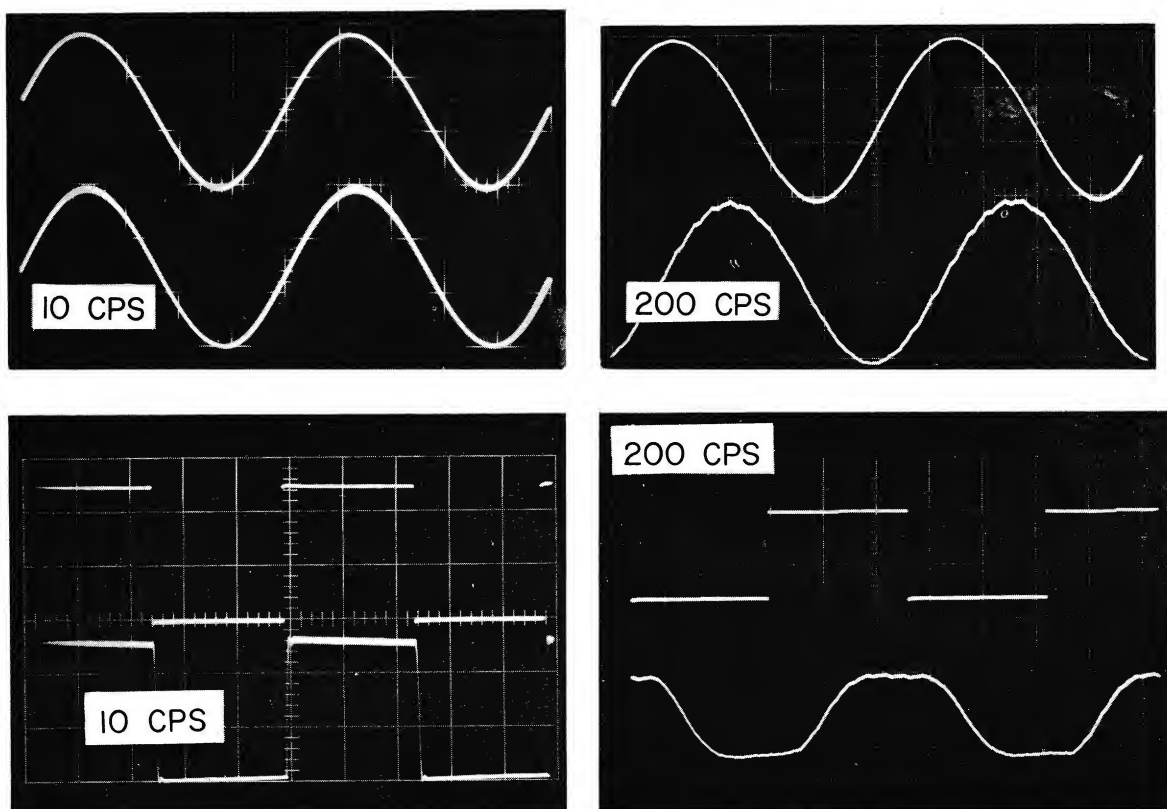


Fig. 2. Four oscilloscope photographs show the overall response of Model 310-1 voltage-controlled-oscillator and Model 410-1 F-M demodulator, at frequencies 10 and 200 Hz, and for sine and squarewave signals. The upper curve in each pair is the VCO input, lower curve is the demodulator output.

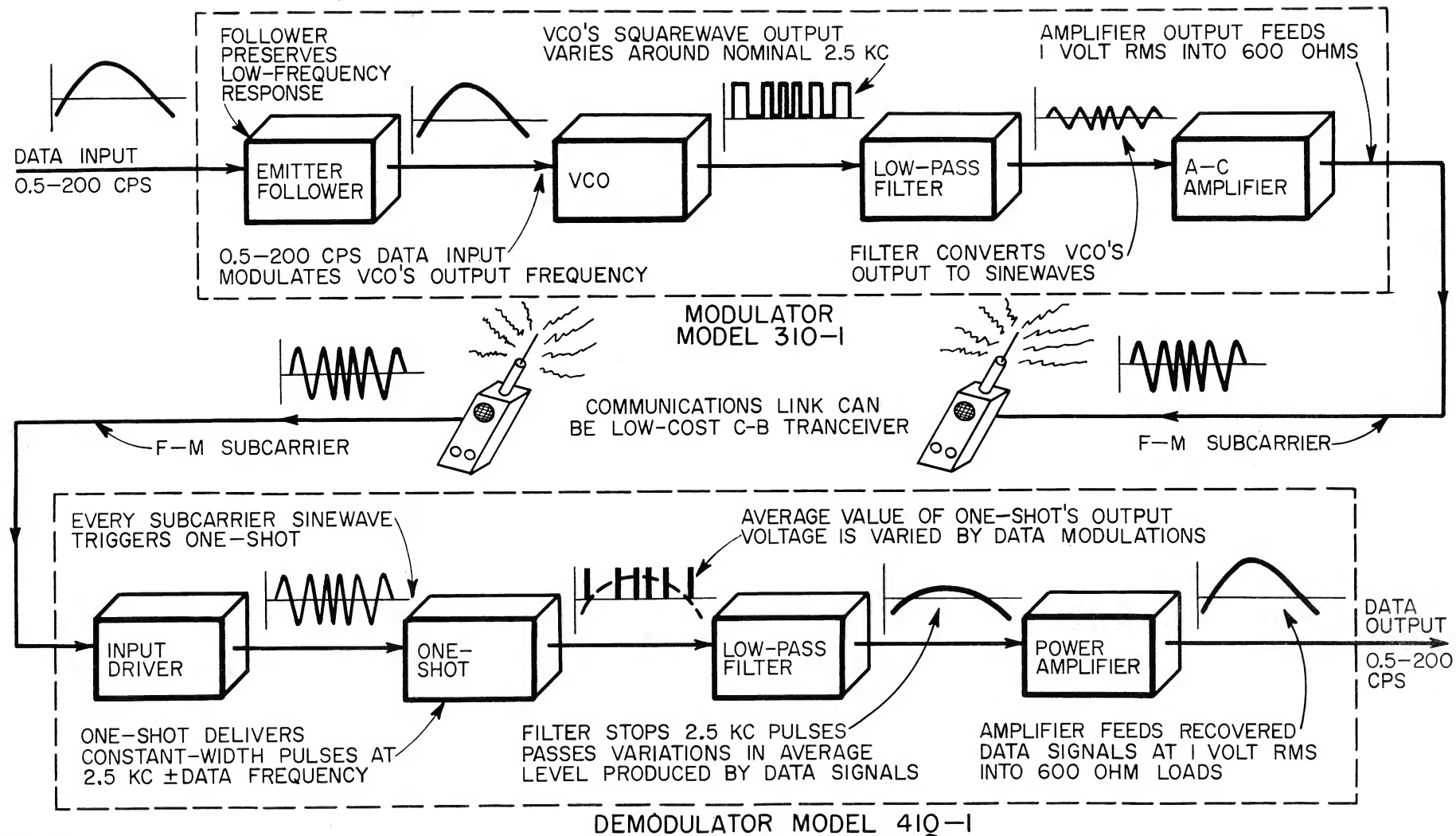


Fig. 3. Block-diagram of Model 310-1 showing low-frequency data signals in the range 0.5 to 200 Hz frequency-modulating a 2,500 Hz carrier output ready for transmission over a conventional communications link to the remote demodulators, in a typical application. At the receiving end, the F-M demodulator Model 410-1 recovers the data signal from the incoming 2,500 Hz carrier, and restores it to the original amplitude and frequency range.

Connections:

310-1 VCO Modulator

- Pin 1. Ground
- Pin 2. +12 VDC Supply
- Pin 3. FM Output
- Pin 4. Not used
- Pin 5. High Sensitivity Signal Input
(0.7 VRMS, maximum)
- Pin 6. Normal Sensitivity Signal Input
(1.0 VRMS, maximum)
- Pin 7. Not used
- Pin 8. Not used

410-1 FM Demodulator

- Pin 1. Ground
- Pin 2. +12 VDC Supply
- Pin 3. AC Coupled Output
- Pin 4. DC Coupled Output
- Pin 5. FM Signal Input
- Pin 6. Not used
- Pin 7. Not used
- Pin 8. Connect 5k pot from 8. to ground
(pin 1), to control gain. For
maximum gain, short 8. to 1.



MF Electronics Corp.

118 EAST 25th STREET, NEW YORK, N.Y., 10010—212 • OREGON 4-5360